Third Report on the Remedial Action to Isolate DDT from People and the Environment in the Huntsville Spring Branch-Indian Creek System, in Wheeler Reservoir, Alabama. Volume 1. Activity Report

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Review Panel Activities HSB-IC System DDT Remedial Action (3rd Report)

Chairman's Letter

This third report of Review Panel Activities, United States v. Olin Corporation Consent Decree, July 1, 1990 - April 23, 1999 reflects significant progress in reducing DDTR levels in fish, water, and sediments. Although the performance standard has not yet been achieved for all fish, there are numerous indicators that the Remedial Action continues to reduce DDT exposure to people and the environment.

This report and appendices (in separate volumes) mark the transition from planning and constructing a remedy to monitoring changes. In order to fairly evaluate that change, this report has included all of the post-construction monitoring (1988-1997) and summaries of earlier decisions by the Review Panel. The report summarizes Review Panel activities which assure that: data are valid and accurate for use in evaluating the remedy, sampling is representative of environmental conditions, and the remedy is operating as anticipated.

This report also marks another important transition. On November 2, 1996, Ms. Anne Asbell, second chair of the Review Panel, lost her battle with cancer. Ms. Asbell was more than a thoughtful and tireless leader. She was a teacher and colleague, who challenged everyone associated with this project to apply their best talents, collaboratively, to achieve solutions to tough problems. She also reached out with empathy to the communities affected by this and other environmental problems in order to understand their needs and concerns.

Again in this phase of the project, the Review Panel has demonstrated the power of collaboration among federal, local, and state governments and industry to achieve environmental benefits.

As the new chair, I am heartened by our progress and the continuing commitment of the Review Panel and Olin to achieve a successful resolution of the DDT contamination of the Huntsville Spring Branch-Indian Creek system. I am confident that we will succeed.

Sincerely,

Edward S. Bender, Ph.D.
Chair, Review Panel
(202) 564-6483

Acknowledgments

Environmental problems are among the most profound and complex dilemmas facing society. These problems often arise from long-term practices that were intended to address disposal problems of one party, without understanding the consequences. Equitable, long-term solutions to these problems involve more than just sanctions, construction, or penalties. Responsible and affected parties must come together in a group, to confront the issues, develop solutions, and commit both time and money to implement and evaluate the remedies.

The progress that has been achieved on this remedial action is a testament to the resilence of this natural system and the commitment and trust of many outstanding individuals; Review Panel members, staffs of their organizations, Olin Corporation, and consultants to the Review Panel. The Review Panel specifically recognizes the late Ms. Anne Asbell in the dedication, and Mr. Bruce A. Brye, P.E., who continues to advise the Review Panel as a consultant. The following people also merit special thanks and acknowledgment: Arthur G. Linton, Michael R. Carter, Andrew Hey, and Dr. H. Lavon Revels, U.S. Environmental Protection Agency; E. John Williford and John T. Hughes, Alabama Department of Environmental Management; Dr. Brian Hughes, Alabama Department of Public Health; Sharon Del Champs and H. Tucker Stone, U.S. Fish and Wildlife Service; William L. James, U. S. Army Corps of Engineers, Nashville District; Keith D. Roberts and R.W. (Bob) Hyland , Olin Corporation; Verrill M. Norwood, Consultant to Olin; Daniel Dunn, Susan Weber, and Morris W. (Bill) Schroder, Redstone Arsenal; Neil Carriker and Donald Dycus, U.S. Tennessee Valley Authority.

The successful completion of this phase of the implementation of the Consent Decree is a tribute to the diligence, cooperative spirit, mutual trust, open communication, and integrity of the participants from the town of Triana, Olin Corporation, the State of Alabama, and the Federal Community. The high quality of information and level of understanding regarding this project is based in large measure on the professional attitude and actions of field and laboratory technicians, inspectors, analysts, and reviewers associated with each of these organizations.

The U.S. Environmental Protection Agency has funded the publication of these two volumes for the Review Panel.

Dedication

This report is dedicated to the memory of Anne L. Asbell, Review Panel Chair January 1, 1988 through November 2, 1996. Ms. Asbell's leadership of the Review Panel began with the formation of the Panel on June 13, 1983 in her capacity as Counsel. She emulated the qualities of integrity, vision, and perseverance which have been keystones for our progress. Ms. Asbell encouraged all participants to voice their concerns and develop consensus solutions. Her love of birds, particularly migratory waterfowl, and the natural beauties of Wheeler National Wildlife Refuge often set the venues for the Review Panel deliberations. Today, a monument on Redstone Arsenal marks a favorite spot for Anne to observe the project "Anne Asbell Overlook".

Executive Summary

On May 31, 1983, U.S. District Court Judge Robert B. Propst entered, as part of an order settling litigation against Olin Corporation, a Consent Decree (CD) governing remedial action for DDTR[1] contamination in the Huntsville Spring Branch-Indian Creek (HSB-IC) system. The CD requires Olin to develop and implement a plan consistent with the goals and objectives of the CD to meet a performance standard of 5 parts per million (ppm) DDTR in filets of channel catfish, largemouth bass, and smallmouth buffalo in specified reaches of the HSB-IC system.

The CD established a Review Panel (RP) with voting members from the U.S. Environmental Protection Agency (EPA), Tennessee Valley Authority (TVA), U.S. Fish and Wildlife Service (FWS), Department of the Army (DOA), and Alabama Department of Environmental Management (ADEM), and non-voting participants from Triana, Alabama (Triana) and Olin Corporation (Olin).

This is the third report on the remedial action to isolate DDTR in the Huntsville Spring Branch-Indian Creek system from people and the environment since the Consent Decree was entered on May 31, 1983. The first report, covering May 31, 1983 to June 30, 1986, addressed the establishment of the project Review Panel (RP), Olin's studies implemented to determine baseline conditions before the remedial action, and the development and beginning of construction of the initial phase (Upper Reach A, Huntsville Spring Branch Miles 4.0-5.4) of the remedial action. The second report addressed the period from July 1, 1986 through June 30, 1990, which included the initiation of the second phase of remedial action (Lower Reach A, Huntsville Spring Branch Miles 4.0-2.4), through the completion of construction of the remedial actions in both Upper Reach A and Lower Reach A on January 1, 1988 and the initiation of the first two years of the long term monitoring program.

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[1] For purposes of the CD and as used in this report, DDTR is defined as 1,1,1-trichloro-2, 2bis-(p-chlorophenyl) ethane (DDT), including its isomers, and the degradation products and metabolites DDD or TDE (1,1-dichloro-2,2-bis-(p-chlorophenyl) ethane), and DDE (1,1-dichloro-2,2-bis-(p-chlorophenyl) ethylene), and their isomers.

This third report addresses the calendar period from July 1, 1990 to April 23, 1999. Its primary focus is the 10 year monitoring period from January 1, 1988 to December 31, 1997. During this period, Olin monitored levels of DDTR in water and selected fish species in the HSB-IC system to determine if the Remedial Action was meeting the performance standard for selected fish species in a manner that was consistent with the goals and objectives of the Consent Decree. During this reporting period, the RP completed five decision documents associated with administration of the CD requirements and one court order modifying the schedule for the Consent Decree.

In terms of isolating DDTR, concentrations in water and fish are the primary measures of the effectiveness of the remedial action. DDTR concentrations in the water column have decreased by 97% since remediation of the HSB-IC system.

For fish, largemouth bass achieved "continued attainment" (i.e., the performance standard has been met for three consecutive years) in all three designated stream reaches in 1994. Channel catfish in Reach A achieved initial attainment of the performance standard (met the standard for one year) in 1997. Channel catfish in Reaches B and C and smallmouth buffalo in Reaches A, B, and C did not meet the performance standard in 1997. The channel catfish are very close and the smallmouth buffalo are approaching the performance standard. All three (3) species have shown at least a 90% reduction overall for average DDTR concentration in fish filets.

The CD provides conditions and guidance to seek an extension of time if the performance standard has not been met and if Olin has acted in good faith (see Appendix B, paragraph 40 of the Consent Decree). Based on the reductions in DDTR concentrations in fish and water during the 10 year monitoring period, the achievement of the goals and objectives of the Consent Decree, the structural integrity of the remedy, and consideration of public comments, the Review Panel has found that Olin had acted in good faith.

The Review Panel concurred with Olin's request for the extension of the time to attain the performance standard of 5 years for catfish and 10 years for smallmouth buffalo. The basis for the period of time includes past experience of the

RP agencies at this and other sites and analyses of existing data presented by Olin (Annual Report No. 10). This extension is subject to the conditions that Olin submits proposals to the Review Panel for a monitoring program, interim goals and a contingency plan if the performance standard is not met. The current monitoring program will be continued until the Review Panel approves a new program.

In addition to meeting the performance standards in fish, the Consent Decree specified seven specific goals and objectives for the remedial action. Each of these goals and objectives has been achieved at this time.

Both parties have petitioned the court for an extension of time February 25, 1999. The extension was granted by the court on April 23, 1999.

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VOLUME 2. APPENDICES

Introduction

On May 31, 1983, the United States District Court for the Northern District of Alabama (Northeastern Division, the Honorable Robert B. Propst presiding) entered, as part of an overall order settling litigation between the United States of America, the state of Alabama, and four sets of private parties against Olin Corporation (Olin), a Consent Decree (CD) that governs development and implementation of a remedial action for DDTR[2] contamination in the Huntsville Spring Branch-Indian Creek (HSB-IC) system. The Consent Decree-defined the goals and objectives, a Performance Standard, and a broad schedule for the Remedial Action. The CD also established a Review Panel of federal agencies and the state of Alabama with the town of Triana, and Olin Corporation as non-voting members. The RP administers the technical requirements of the CD and monitors progress toward achieving compliance.

A. Purpose and Scope

This is the third report on the remedial action to isolate DDTR in the Huntsville Spring Branch-Indian Creek system from people and the environment since the Consent Decree was entered on May 31, 1983. The purpose of this report is to summarize the activities and finding of the Review Panel concerning the Remedial Action and attainment of the Performance Standard. For details, refer to the cited references, consent decree, and decision documents of the RP.

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[2] For purposes of the CD and as used in this report, DDTR is defined as 1,1,1-trichloro-2, 2bis-(p-chlorophenyl) ethane (DDT), including its isomers, and the degradation products and metabolites DDD or TDE (1,1-dichloro-2,2-bis-(p-chlorophenyl) ethane), and DDE (1,1-dichloro-2,2-bis-(p-chlorophenyl) ethylene), and their isomers.

The first report[3] (May 31, 1983 to June 30, 1986) addressed the establishment of the project Review Panel (RP), Olin's studies implemented to determine baseline conditions, and the development and beginning of construction of the initial phase (Upper Reach A, Huntsville Spring Branch Miles 4.0-5.4) of the remedial action. The second report[4] (July 1, 1986 through June 30, 1990) included the initiation of the second phase of remedial action (Lower Reach A, Huntsville Spring Branch Miles 4.0-2.4), through the completion of construction of the remedial actions in both Upper Reach A and Lower Reach A on January 1, 1988 and the initiation of the first two years of the long term monitoring program.

This third report addresses the calendar period from July 1, 1990 to December 31, 1998. Its primary focus is the 10 year monitoring period (January 1, 1988 to December 31, 1997). The inclusion of calendar year 1998 in this report is necessary because the 1997 monitoring results were not available until May 1998. This report also addresses the plan of action for ensuing years to address the Consent Decree established performance standards for catfish and smallmouth buffalo which were not achieved during the 10 year monitoring period. The RP will issue further reports as necessary to inform the public when significant milestones are achieved.

The Department of Justice filed a joint petition on behalf of the federal parties with Olin to modify the schedule for meeting the performance standard consistent with the Review Panel decision. On April 23, 1999, the United States

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[3] Report on the Remedial Action to Isolate DDT from People and the Environment in the Huntsville Spring Branch-Indian Creek System, Wheeler Reservoir, Alabama, Review Panel Activities (United States vs. Olin Corporation Consent Decree), May 31, 1983-June 30, 1986, Environmental Protection Agency, Region IV, Atlanta, Georgia, July, 1986.

[4] Second Report on the Remedial Action to Isolate DDT from People and the Environment in the Huntsville Spring Branch-Indian Creek System, Wheeler Reservoir, Alabama, Review Panel Activities (United States vs. Olin Corporation Consent Decree), July 1, 1986-June 30, 1990, Environmental Protection Agency, Region IV, Atlanta, Georgia, July, 1986.

District Court, Northern District of Alabama, Northeastern Division issued an order extending the time for attainment of the performance standard until December 31, 2002 for channel catfish and until December 31, 2007 for smallmouth buffalo as described in the Review Panel Decision Document Number 11.

Chapter 1 Historical Background

Following the Environmental Protection Agency's (EPA) 1972 ban on production, sale, or use of DDT in the United States, a series of investigations were initiated to evaluate the extent of environmental contamination at places where DDT had been manufactured, stored, or used. One such location was a site at Redstone Arsenal near Huntsville, Alabama where DDT was manufactured from 1947 to 1970. Wastewater discharged from this plant had resulted in extensive contamination of Huntsville Spring Branch and Indian Creek.

A. Studies Prior to December, 1980

During the late 1970's and early 1980's, the U.S. Army (Army), Tennessee Valley Authority (TVA), EPA, and other federal and state agencies investigated DDT contamination in the Huntsville Spring Branch-Indian Creek (HSB-IC) tributary system of Wheeler Reservoir on the Tennessee River that was associated with this facility. Results of those studies led to a series of discussions among EPA, the Army, Olin Corporation, TVA, U.S. Fish and Wildlife Service, Alabama Department of Environmental Management, and Alabama Department of Health that were reflected in the 1983 Consent Decree requirements.

B. Consent Decree

The purpose of the Consent Decree requirements (remedial actions, monitoring, and other actions) are to isolate DDTR in the HSB-IC system from people and the environment, to minimize transport of DDTR out of the HSB-IC system, and to protect human health and the environment. To achieve these purposes the CD required Olin to plan, implement, and monitor remedial actions to achieve a performance standard of 5 parts per million (ppm) DDTR in filets of channel catfish, largemouth bass, and smallmouth buffalo in specified reaches of the HSB-IC system:

Reach A - Huntsville Spring Branch mile (HSBM) 5.4-2.4
Reach B - HSBM 2.4-0.0, and

Reach C - Indian Creek mile (ICM) 5.6-0.0.

A map identifying these reaches is shown in figure 1.

The performance standard was to be met for at least one year ("initial attainment") within 10 years after completion of construction and implementation of the remedial action. The CD defines "initial attainment" as an average concentration of DDTR of 5 ppm or less in the fish filets for one year for each performance standard species and each reach. Once "attainment" was achieved Olin must demonstrate "continued attainment" (i.e., meet the performance standard for three (3) consecutive years). After continued attainment is achieved for all species and in all reaches, Olin must maintain and operate the remedy for a period of 7 years. If attainment is again demonstrated during the seventh year of this period and the Remedial Action is deemed to be effective by the RP, the Consent Decree terminates.

The CD also required that the performance standard be achieved by a remedy that was consistent with the following goals and objectives:

1. Isolate DDT from people and the environment in order to prevent further exposure;

2. Minimize further transport of DDT out of the HSB-IC system;

3. Minimize adverse environmental impacts of remedial actions;

4. Mitigate effect of DDT on wildlife habitats in Wheeler Reservoir and Wheeler National Wildlife Refuge (WNWR);

5. Minimize adverse effects on operations at Redstone Arsenal (RSA), Wheeler Reservoir, and WNWR.

6. No increase in flooding, especially at the city of Huntsville and RSA, except those increases in water level that can reasonably be expected in connection with implementation of remedial action, provided Olin takes all reasonable steps to minimize or prevent such increase; and

7. Minimize the effect of loss of storage capacity for power generation, in accordance with the Tennessee Valley Authority Act.

The CD incorporates by reference the "Joint Technical Proposal To Implement Remedial Activities Pursuant to Consent Decree" (referred to as the Joint Technical Proposal) which serves as the conceptual basis for the studies undertaken to develop and implement remedial actions to meet the requirements of the CD (See Appendix A). Topics addressed in the Joint Technical Proposal included review of existing data, acquisition of baseline data, DDTR exposure and uptake pathway investigations, aquatic biota resource evaluations, sediment and suspended sediment evaluations, remedial action alternatives, long term monitoring, and quality assurance.

A chronology of the major events from May 30, 1983, the date the Consent Decree was issued, through April 23, 1999 is presented in Appendix A.. The Consent Decree and the Joint Technical Proposal are included in Appendix B.

C. Review Panel

The Consent Decree provided for oversight of the remedial activities required by the Consent Decree by the establishment of a Review Panel (RP). The RP is chaired by the U.S. Environmental Protection Agency (EPA) and consists of voting member representatives from EPA, Tennessee Valley Authority (TVA), U.S. Fish and Wildlife Service (FWS), the Department of the Army (DA), the State of Alabama Department of Environmental Management (ADEM), and non-voting participants from Triana, Alabama (Triana) and Olin Corporation. The current Review Panel members and former members are identified by agency in Appendix C.

Review Panel responsibilities include reviewing data and acting on proposals for the remedial action, interim goals, substitute species, long-term monitoring program, and other appropriate matters to implement the Consent Decree. If the RP determines that modifications are necessary to meet the 5 ppm performance standard established in the CD, the RP may seek such modifications or petition the court for an extension of time to attain the performance standard.

The RP established operating procedures through a "Memorandum of Agreement, Review Panel Operating Procedures", dated January 26, 1984.

In August 1983, a Technical Committee was established by the Review Panel. This Committee is chaired by EPA and includes technical staff from represented agencies and non-voting members. The purpose of the Committee is to provide a forum for the discussion and resolution of technical issues between the technical staff of the Review Panel agencies and Olin. A report of the discussions and the resolution of issues is then presented to the full Review Panel.

In July 1987, the Review Panel Chairman established an Inspection Committee to verify compliance and certify construction of the remedial action remedy in accordance with Review Panel-approved plans and to identify items needing to be addressed. This Committee was chaired by a Review Panel member who is a registered Professional Engineer in the State of Alabama and includes technical staff from the Review Panel-represented agencies. This Committee makes annual inspections to verify the integrity of the remedy.

Chapter 2 Remedial Actions

The Review Panel approved and Olin implemented remedial actions to isolate DDTR from people and the environment in two stages. The combined effect of these two remedial actions effectively isolated in place approximately 93 percent of the DDTR in the HSB-IC system. The combined remedies are shown in Figure 2.

A. Remedial Action Upper Reach A (HSBM 5.4 to 4.0)

On August 31, 1984 the Review Panel approved with modifications Olin's proposed remediation plan for Upper Reach A (URA). The remedial action involved the rerouting of the channel in Upper Reach A, the filling and burial in place of the DDTR in the old Channel, the construction of diversion structures at the upper and lower end of the stream to prevent stream reversion to the former stream channel and the diversion of storm water runoff to prevent flow across the filled channel. This action effectively isolated at least 95 % of the DDTR estimated to occur in Upper Reach A.

The major modifications required with the approval of this remedial action for Upper Reach A were that Olin submit a plan for the removal and/or isolation of DDTR in Lower Reach A (HSBM 4.0-2.4), and perform a study to further identify the extent of DDTR contamination in Reaches B and C.

B. Remedial Action Lower Reach A (HSBM 4.0 to 2.4)

On December 9, 1986, The Review Panel approved Olin's remedial action plan for Lower Reach A (LRA). The remedial action consisted of constructing four diversion structures; excavating a new channel between HSBM 3.4 and 2.4; filling three areas; constructing a diversion ditch around the fill areas; and excavating portions of the sediments from the channel. The construction area was entirely within the safety fan of one of the missile test ranges at RSA and within the zone influenced by the operation of Wheeler Reservoir. Therefore the construction was closely coordinated with operations of both the test range and the reservoir. Because of the activities at the test range, much of the construction was performed at night under lights. The remedial action in LRA effectively isolated

approximately 94 percent of the DDTR within this reach.

Table 1 summarizes the distribution of DDTR in the HSB-IC system by reach and the DDTR isolated by the remedial action.

Table 1. Distribution of DDTR in Sediments and Isolation of DDTR by Remedial Action in Reaches A, B, and C.

Reach	Quantity in Sediments (tons)	Percent of Total in Sediments	Quantity Isolated (tons)	Percent of System Total Isolated
Upper A	317.9	77.8	308.0	75.3
Lower A	75.6	18.5	71.0	17.4
Subtotal A	393.5	96.3	379.0	92.7
B	8.2	2.0	0	0
C	7.1	1.7	0	0
Total	408.8	100	379.0	92.7

Baseline conditions from Table 1 Second RP Activity Report.

C. Certifications, Permits, and Licenses

Olin's remedial actions for Reach A involved certifications, permits and licenses from the following agencies: ADEM, USACE, RSA, FWS, and TVA. Olin made timely applications and provided information to each agency to satisfy its regulations and permit issuance process. Special terms and conditions

incorporated in the individual permits were coordinated among the agencies and the RP to maintain continuity and avoid conflict with the requirements of the permits and the CD. In addition, the issuance of these permits and licenses was supported by the preparation and issuance of an environmental impact statement as contemplated by the National Environmental Policy Act.

D. Construction

Construction of the Remedial Actions was covered in the Second Report of the Review Panel (pp. 6-8). The Remedial Action areas are shown in Figure 2 and highlights of the construction are included in Appendix A, Project Chronology. Olin began construction in Upper Reach A on April 1, 1986 and major construction of both upper and lower Reach A was completed July 22, 1987. Throughout the construction, Review Panel agencies monitored progress, changes, and impacts of construction.

E. Completion of Construction

Representatives of the agencies which issued certifications, permits, and licenses conducted a joint inspection of the remedial action site on August 3, 1987 and certified to the Review Panel by letter dated August 19, 1987 that the remedial actions were constructed in accordance with the terms and conditions of their respective permits.

The Review Panel Inspection Committee inspected the site on August 27, 1987 to verify completion of construction in accordance with the plans approved by the Review Panel. By letter dated September 14, 1987, the Chairman of the Inspection committee certified to the Chairman of the Review Panel that:

> "...the as-built Remedial Actions for the Upper Reach A and Lower Reach A meet or exceed the requirements of the design plans and specifications initially approved by the Review Panel. Furthermore with Olin's commitment for the completion of final project redress, as needed, and the establishment of acceptable vegetative cover in conjunction with the planned regulatory agencies' follow-up inspections, it is concluded that Remedial Action construction is

completed with respect to further actions required by the Review Panel."

Based on the certification from the Inspection Committee, the Review Panel on December 3, 1987 designated January 1, 1988 as the official date for the completion of construction and the initiation of the 10 year long term monitoring program as required by the Consent Decree.

On October 2, 1998, James Warr, Chair of the Inspection Team noted in a summary of findings that " natural succession [of vegetation] has occurred and is occurring without threatening the stability of the remedy." In fact, vegetative cover has flourished to a point that "intrusive actions may be necessary if reviews are to continue on an annual basis". Neither the Review Panel nor Olin have identified items which will need further redress at this time.

Chapter 3 Long-Term Monitoring

The Review Panel identified January 1, 1988 as the official date for the completion of construction and the initiation of the 10 year monitoring period as required by the Consent Decree. This chapter discusses monitoring program results during this period from January 1, 1988 through December 31, 1997. Since the calendar year 1997 monitoring results were not available until May 15, 1998, Olin voluntarily, with Review Panel concurrence, continued the long term monitoring program in calendar year 1998 (the 11th year) to provide continuity of data.

The baseline conditions used to evaluate the progress achieved in meeting the Consent Decree were established by the Review Panel on October 28, 1986 (Decision Document 2). The overall Long Term Monitoring program to determine progress toward achievement of the Consent Decree requirements was approved by the Review Panel on December 3, 1987 (Decision Document 6). The monitoring program was subsequently modified December 7, 1989 (Decision Document 6). Additional revisions to the monitoring program have been made in Decision Document No. 7, Quality Assurance and Fish Sample Size, June 14, 1990, and Decision Document No. 8, Groundwater Monitoring, December 6, 1990.

A. Fish

The Consent Decree established a performance standard that the remedial action must attain. The performance standard is a DDTR level of 5 parts per million (ppm) in the filets of channel catfish, largemouth bass, and smallmouth buffalo, in Reaches A, B, and C of the HSB-IC system. Reaches A, B, and C were defined as:

Reach A – Begins at HSBM 5.4 and extends to HSBM 2.4
Reach B – Begins at HSBM 2.4 and extends to HSBM 0.0
Reach C – Begins at ICM 5.6 and extends to ICM 0.0

The year 1997 was the 10th year after completion of the remedial action construction. Baseline vs. 1997 fish monitoring results are summarized in Table 1. The DDTR data included in the table for largemouth bass are 1996 data since

monitoring of a performance standard species is not required after "continued attainment". "Continued attainment" for the largemouth was achieved at each reach in 1994, thus Olin is no longer required to monitor this species.

Table 2
DDTR in Performance Standard Fish, Baseline to 1997

Species	Reach	DDTR Concentration (ppm) in Fish Filet			% Change
		Baseline	1988	1997	
Channel Catfish	A	95	33	5.0	-95
	B	69	45	6.9	-90
	C	66	36	5.5	-92
Largemouth Bass	A	7.1	5.6	1.5 (1996)	-79
	B	37	5	1.1 (1996)	-97
	C	8.2	2.7	0.5 (1996)	-94
Smallmouth Buffalo	A	140	31 (1989)	12	-91
	B	180	82	21	-88
	C	110	89	9.4	-92

Channel catfish in Reach A attained the performance standard in 1997. Channel catfish in Reaches B and C and smallmouth buffalo in Reaches A, B, and C have not yet achieved the performance standard. The channel catfish are very close and the smallmouth buffalo are approaching the performance standard. All three (3) species have shown a 90% reduction overall in average DDTR concentrations in filets through 1997. Since the performance standard has not been met for channel catfish and smallmouth buffalo, Olin has devoted considerable effort to statistical analysis of the fish data for the period from completion of construction through 1997. Particular attention has been directed to fish spawned since the completion of construction. The focus of the statistical analysis was to predict when a fish species (by Reach and overall) would reach 5 ppm. All data analysis indicate that progress towards the performance standard is continuing.

B. Water

The principal route of DDT exposure to fish and wildlife is through surface water. DDT concentrations in the water column have decreased by at least 97% since remediation of the HSB-IC system. Baseline vs. 1997 water sampling results are shown in Table 3.

Table 3. DDTR in HSB-IC Water, Baseline to 1997

Sample	Reach	DDTR Concentration (ppb) in Water			%Change
		Baseline	1988	1997	
HSBM 9.75	Upstream of A	0.77	0.0*	0.0*	
HSBM 4.85	A	3.4	0.0*	0.0*	>-98
HSBM 3.9	A	12	0.35	0.0*	>-98
HSBM 2.4	A	13	1.23	0.05	>-98
ICM 4.6	C	4.3	1.51	0.11	>-97
ICM 0.38	C	1.7	0.54	0.0*	>-98
ICM 8.2	Upstream of C	0.6	0.0*	0.0*	

*These values were below the limit of analytical quantification.

Average DDTR concentrations in the water column are significantly lower than baseline conditions (pre-remedial action) throughout the entire HSB-IC system. DDTR concentrations at the former monitoring station at HSBM 4.0 averaged 12 ug/l (ppb) prior to remediation. DDTR concentration in the water at HSBM 3.9 was nondetectable (<0.05 ug/l) during the two water collections in 1997. This is a reduction of >98% compared to baseline. DDTR concentrations at HSBM 2.4 averaged less 0.10 ug/l during the two 1997 water collections. This is a >98% reduction of DDTR compared to baseline (13 ug/l) DDTR concentrations in the water at HSBM 2.4. DDTR reductions at ICM 4.6 and ICM 0.38 are 97% and >98% compared to baseline, respectively.

C. Quality Assurance

An extensive quality assurance (QA) program including the analysis of intra laboratory split, blind, and standard reference samples in conjunction with inter laboratory split samples with a referee laboratory (EPA's Region IV Laboratory, Athens, GA) has been a required part of all data acquisition under the Consent Decree and the Joint Technical Proposal. During the long term monitoring period all of the data reported by Olin has been certified as valid data by both Olin and the EPA Region IV laboratory.

D. Project Goals and Objectives

In addition to meeting the performance standards in fish, the Consent Decree specified other goals and objectives for the remedial action. Progress toward achieving goals and objectives is discussed below:

Goal 1. Isolate DDTR from people and the environment in order to prevent further exposure.

The remedial action isolated 92.7% of the DDTR in the HSB-IC system from people and the environment. The remedial action has enhanced the natural restoration processes in the HSB-IC system by isolating the highest DDTR concentrations which may be toxic to organisms that metabolize DDTR, exposing new sources of clean sediments, and increasing levels of oxygen in water to promote aerobic degradation. Natural restoration processes have continued to isolate additional DDTR from people and the environment.

Goal 2. Minimize further transport of DDTR out of the HSB-IC system.

In the days before remediation, an average of 4.0 pounds per day of DDTR was transported out of Indian Creek (IC) by stream flows. Post-remediation, the amount had decreased to below quantification limits in 1997. Prior to remediation, the highest quantities of DDTR were moved during storm events in the HSB-IC system. DDTR concentrations in the water during storm events since remediation action are typically below quantification

limits throughout the system.

Goal 3. Minimize adverse environmental impact of remedial actions.

Adverse environmental impacts from the Olin remedial project appear to be minimal. In fact, the system itself has shown improvement in several ways. Water quality in Huntsville Spring Branch has also been improved when the discharge from the municipal wastewater treatment plant of the City of Huntsville was moved from Huntsville Spring Branch to the Tennessee River in 19. Shortly after the beginning of construction of the remedial action, DDTR concentrations in the water column began to decrease. After completion of remediation, DDTR concentrations continued to decrease rapidly in water and biota. The number of fish species and fish abundance has increased. Populations of largemouth bass, sunfish and other game fish have increased. The abundance and diversity of the macroinvertebrate community has improved. Dissolved oxygen has increased in the water. Dissolved oxygen was often low with wide fluctuations before remediation began. The remediated land areas are home to deer, small mammals, many species of birds, and other biota.

Goal 4. Mitigate effect of DDTR on wildlife habitats in the Wheeler National Wildlife Refuge.

The isolation of over 92% of the DDTR in the HSB-IC system has significantly decreased DDTR concentrations in red-wing blackbirds, wood ducks, macroinvertebrates, and fish. Channel catfish and smallmouth buffalo are approaching 5 ppm. Largemouth bass have attained and demonstrated continued attainment with the performance standard of 5 ppm.

Goal 5. Minimize adverse effects on operations at Redstone Arsenal, Wheeler Reservoir, and Wheeler National Wildlife Refuge.

Generally there has been a good working relationship among all parties and conflicts have been resolved. Access roads and new channels have greatly improved the access to the area for Arsenal and Refuge operations.

Goal 6. No increase in flooding, particularly at City of Huntsville and Redstone Arsenal, except those increases in water levels which can reasonably be expected in connection with the implementation of remedial action, provided Olin takes all reasonable steps to minimize or prevent such increase.

> The channel profiles were constructed to provide carrying capacity as existed upstream and there have been no problems. In fact, the water moves through the system more freely than in pre-construction days. The remedial action eliminated a major restriction in the flow channel of Huntsville Spring Branch. Subsequently, flooding has decreased upstream of the remedial action area on Redstone Arsenal.

Goal 7. Minimize effect on loss of storage capacity for power generation, in accordance with the Tennessee Valley Authority Act ("TVA Act").

> The design and construction of the remedial action minimized the loss of storage capacity in the Huntsville Spring Branch area.

The goals and objectives as set forth in the Consent Decree have been met through this stage of the remedial action.

E. Structural Integrity of the Remedy

From 1991 through 1998, the Inspection Committee has made annual on site inspections of the remedial action area to verify the status and structural integrity of the remedy. In a October 2, 1998 letter summarizing the inspections during this period Mr. James W. Warr, Chairman of the Inspection Committee finds:

> ..."that a consistently applied assessment process reflects that natural secession has and is occurring without threatening the stability of the remedy. The area is now in an essential natural state and I find no cause for concern relative to the integrity of the remediation."

No maintenance of the basic structures has been required during the 10 year monitoring period. A copy of the letter summary of the Inspection Committee is included in Appendix D.

F. Extension of the Monitoring Period

The Consent Decree recognized the possibility that the performance standard in fish might not be attained at the end of the 10 year monitoring period. In this regard, paragraph 40 of the CD states:

> "If Olin and the United States agree that Olin has acted in good faith consistent with the schedule set forth in this Consent Decree but has failed to meet the performance standard with the time set forth herein, Olin and the United States shall agree to an extension of time for meeting the performance standard...."

In its report of the 1997 monitoring data, Olin provided an extensive evaluation of the progress made towards meeting all performance standards and the prospects of attaining the performance standard for catfish and smallmouth buffalo. Based on these evaluations Olin recommended an extension of time of 5 years for the catfish and 10 years for smallmouth buffalo.

Based on the reductions in DDTR concentrations in fish and water during the 10 year monitoring period, the achievement of the goals and objectives of the Consent Decree, the structural integrity of the remedy, and public comments, the Review Panel found that Olin acted in good faith. Olin's good faith is further evidenced by the cooperation which they have shown in responding to all requests for additional information and data. A list of documents which Olin has provided under the Consent Decree is included in Appendix E.

The Review Panel concurred with Olin's request for the extension of the time to attain the Performance Standard of 5 years for catfish and 10 years for smallmouth buffalo (See Appendix I, Decision Document No. 11). This extension was subject to the condition that Olin submit proposals to the Review Panel for the following:

1. a monitoring program for the balance of the time extension;
2. interim goals for the time extension; and
3. contingency plans in the event that the interim goals or performance standards are not attained within the period

of the time extension.

The current monitoring program will remain in effect until the Review Panel approves a modification.

The United States and Olin jointly petitioned the court to modify the schedule in the consent decree. The court approved modifications to the schedule as proposed by the petition on April 23, 1999.

Chapter 4 Administrative Actions

The Review Panel met 16 times between July 1, 1990 and December 31, 1998. Meetings were held at RSA, WNWR, and Triana.. Meetings were announced by press releases issued by EPA to local news media and to the Associated Press and United Press International wire services. The RP also held public meetings on July 13, 1993 and September 15, 1998.

The Review Panel documents key deliberations relating to its administrative responsibilities under the Consent Decree through signed decision documents. Prior to July 1, 1990 the Panel had issued one Memorandum of Understanding and seven decision documents. These documents were discussed and appended in full in the first two Review Panel reports. However, for purposes of continuity, these documents have been summarized in the first section of this chapter.

During this reporting period, the RP completed four additional decision documents (Nos. 8-11) associated with administration of the CD requirements. These documents are summarized in the second section of this chapter and appended in full in the appendices F-I of this report.

A. Decision Documents Prior to July 1, 1990

"Memorandum of Agreement, Review Panel Operating Procedures, January 26, 1984." (See Appendix C, First Review Panel Report)

The RP established operating procedures in the Memorandum of Agreement (MOA), Review Panel Operating Procedures, dated January 26, 1984. The MOA sets forth the guidelines and procedures for the conduct of Review Panel activities and responsibilities. The MOA set guidelines for committees, decisions, and reports. The Review Panel has been fortunate to have the high caliber and professionalism of the agency representatives which have served on the Panel since its initial organization in June 1983. The current Panel members and former Panel members are identified by agency in Appendix C.

In August 1984 a Technical Committee was established by the Review Panel to meet prior to each Review Panel meeting. This Committee is chaired by EPA and includes representation from TVA, FWS, and technical staff from other review panel represented agencies and non voting participants. The purpose of the Committee is to provide a forum for the discussion of technical issues between the technical staff of the Review Panel agencies and Olin. A report of the discussions and the resolution of issues is then presented to the full Review Panel. The current chair of the Technical Committee is Dr. Edward Bender (EPA).

In July 1987 the Review Panel Chairman established an Inspection Committee to verify compliance and certify construction of the remedial action remedy in accordance with Review Panel-approved plans and to identify items needing to be addressed. This committee is chaired by a Review Panel member who is a registered Professional Engineer in the state of Alabama and includes technical staff from the Review Panel represented agencies. The current chair of the Inspection Committee is Mr. James Warr (ADEM).

Initially, quality assurance was evaluated by the Technical Committee. Beginning in 1990, a Quality Assurance Committee was established to pursue issues related to analytical methods and data analysis. The Committee that included both Olin and EPA laboratory staff, met on a regular basis to review sampling, analytical and quality control procedures and results for the monitoring data. Any differences or questions relating to the reliability of the data are resolved before the data are published in a report. Standardization of analytical procedures, statistical analysis, and reporting nomenclature has enhanced the verification and certification process. Olin's annual reports of the long term monitoring results must include both Olin's evaluation of the QA results and a certification from the EPA representative on the QA Committee. Although the QA Committee determines the quality and validity of the monitoring data, the technical interpretation of the data is reserved for the Technical Committee and the Review Panel. Dr. H. Lavon Revels (EPA) and Mr. Keith Roberts (Olin) have led the QA Committee.

Decision Document (Unnumbered, Considered No. 1)--"Olin Corporation Remedial Plan to Isolate DDT From People and the Environment in Huntsville Spring Branch-Indian Creek System, August 31, 1984."

(See Appendix C of the Second Review Panel Report)

This Decision Document is the record of the Review Panel's approval decision to accept, with modifications, the Olin proposed remedial action to isolate DDTR in the Upper Reach A portion of Huntsville Spring Branch (HSB) between Huntsville Spring Branch miles (HSBM) 5.4 and 4.0.

Decision Document No. 2--"Baseline Data, Substitute Species, and Interim Goals for Fish and Water, October 28, 1986."
(See Appendix D of the Second Review Panel Report)

Olin conducted extensive environmental studies of the HSB-IC system during the years 1982- 1985. Based on these studies and evaluation, Olin developed proposals for Review Panel consideration on the issues of baseline data, substitute fish species, interim goals, and long term monitoring. The Review Panel made determinations on: 1)baseline data; 2) substitute species; and 3) interim goals to evaluate the effectiveness of remedial actions and to evaluate progress toward achieving the performance standard for fish as established in the Consent Decree. This document reflects the Review Panel's decision on these three issues. In Decision Document No. 2, the Review Panel requested that Olin provide additional information on a substitute species for largemouth bass.

Decision Document No. 3--"Remedial Action Plan to isolate DDT in Lower Reach A of Huntsville Spring Branch, December 9, 1986."
(See Appendix E of the Second Review Panel Report)

In the approval of the remedial action in Upper Reach A, (Decision Document No. 1) the Review Panel required Olin to develop additional remedial action in Lower Reach A. Decision Document No. 3 is the record of the Review Panel's approval of Olin's proposed remedial action to isolate DDTR in Lower Reach A of Huntsville Spring Branch (HSB) between Huntsville Spring Branch miles (HSBM) 4.0 and 2.4.

Decision Document No. 4--"Report on DDT in Reach B and Reach C on the Huntsville Spring Branch-Indian Creek System, April 16, 1987."
(See Appendix F of the Second Review Panel Report)

In the approval of the remedial action in Upper Reach A, (Decision

Document 1) the Review Panel also required Olin to conduct additional studies to determine the extent of DDTR contamination in Reaches B and C. The Review Panel accepted Olin's Report on DDT in Reach B and Reach C and agreed with the conclusion that no actions appear necessary to meet the performance standard.

Decision Document No. 5--"Substitute Species for Largemouth Bass, July 22, 1987."
(See Appendix G of the Second Review Panel Report)

The Review Panel requested that Olin conduct additional evaluations for the identification of a substitute species for largemouth bass (Decision Document No. 2). In Decision Document No.5 the Review Panel adopted the bluegill sunfish as the best substitute species for a largemouth bass. The Review Panel agreed with Olin's conclusion that bluegill is the best substitute fish.

Decision document No. 6--"Long Term Monitoring Program for the Remedial Action in the Huntsville Spring Branch- Indian Creek System, December 3, 1987, and Modification of Review Panel Decision Document No. 6, December 7, 1989"
(See Appendix H of the Second Review Panel Report)

The long term monitoring program for fish, water, and groundwater to evaluate the effectiveness of the Remedial Action in the achievement of the performance standard and other requirements of the Consent Decree is established in this decision document. An extensive quality assurance program including intra laboratory split, blind, and standard reference samples in conjunction with inter laboratory split samples with a referee laboratory (EPA's Region IV Laboratory, Athens, GA) is also required.

Subsequent to the approval of the initial monitoring plan, Olin requested that the reporting date be changed from March 1, to April 15. This modification was approved on December 7, 1989.

Decision Document No. 7--"Quality Assurance and Fish Sample size, June 14, 1990."

(See Appendix I of the second Review Panel report)

During the review of the first year long term monitoring results (1989), the Technical Committee of the Review Panel identified the need for further interpretation of some of the quality assurance results. After review by both Olin and EPA laboratory staffs several recommendations were made to enhance the analysis, interpretation and certification of the QA results. Revisions included standardization of analytical procedures, the expansion of the statistical analysis, standardization of nomenclature for reporting analytical results and enhancement of the verification and certification process. The target sample size for channel catfish collections was increased to 25 and target sample sizes for largemouth bass and smallmouth buffalo was increased to 12 for each reach.

B. Decision Documents Issued after July 1, 1990

Decision Document No. 8--"Groundwater Monitoring, December 6, 1990"

(See Appendix F, of this report)

The Long Term Monitoring Program included two groundwater monitoring programs: the first includes 5 wells on Redstone Arsenal and 5 off-site public drinking water wells (required by the Technical Proposal and referred to as "far field wells"); and the second includes 37 wells (referred to as the "near field wells") which Olin installed along 5 transects of the filled channel in Reach A.

Since DDTR has not been detected in either set of wells, the RP concurred with Olin's request to terminate monitoring of the "far field wells" and reduce the monitoring frequency of the "near field wells."

Decision Document No. 9--"Process for Review of Monitoring Data and Olin Notification of Compliance by the Technical Committee, January 23, 1992."

(See Appendix G of this report)

The Technical Committee reviews the monitoring data and other relevant information, and makes recommendations to the Review Panel with respect to Olin's compliance with the requirements of the Consent Decree. This Decision Document establishes the Review Panel's guidance to the Technical Committee of the principles to be used in the evaluation and preparation of recommendations to the Review Panel. Specific topics addressed include: data to evaluate compliance, data evaluation principles, procedures for review and evaluation of monitoring data, and evaluation of the remedial action.

Decision Document No. 10--"Process for Review of Olin's Notifications of Continued Attainment by the Technical Committee"

(See Appendix H of this report)

This decision document identifies the generic process which the Technical Committee and the Review Panel will use to address Olin's notification of "continued attainment." Since "continued attainment" for each species and reach may occur at different times. This basic document was developed to incorporate appendices which will be added as continued attainment is achieved on a species and reach basis. Appendices incorporated thus far are:

1. "Appendix A; Finding of Continued Attainment, largemouth Bass, Reach C, January 19, 1995."

2. "Appendix B, Finding of Continued Attainment largemouth Bass, Reach A, July 20, 1995."

3. "Appendix C, Finding of Continued Attainment largemouth Bass, Reach B, July 20, 1995"

Decision Document No. 11--"Extension of Time for Meeting the Performance Standard for Channel Catfish and Smallmouth Buffalo, December 3, 1998."

(See Appendix I of this report)

DDTR concentrations of channel catfish and smallmouth buffalo have decreased throughout the 10 years following the completion and implementation of the remedial action. However, only catfish in Reach A have attained the

performance standard.

The Consent Decree includes specific provisions which outline the actions and considerations available to the Review Panel in this situation. Decision Document 11 details the basis for the RP extension of time to attain the performance standard for channel catfish and smallmouth buffalo. The document also summarizes public involvement in the decision. The RP determined that Olin had acted in good faith and concurred with a time extension for channel catfish of 5 years (i.e., 12/31/2002) and for smallmouth buffalo of 10 years (i.e., 12/31/2007). The RP also required Olin to develop a monitoring plan, interim goals for achieving the performance standard, and contingency plans.

The Department of Justice has petitioned the court and the court has ordered a modification to the Consent Decree schedule for attaining the performance standard (Appendix J).

Chapter 5 Future Directions

The RP will monitor Olin's progress toward attainment of the performance standard until the requirements of the CD are satisfied. These oversight activities will include periodic inspections of the remedial action, evaluating the long term monitoring program results, and, if required, determining any modifications to the remedy required to comply with the CD. The RP will determine when the requirements of the CD such as these have been satisfied.

On June 30, 1990, the RP identified the following short-term goals to be addressed during the next reporting period:

1. Document the RP's approval at its June 14, 1990, meeting of the modification to the long-term monitoring program to discontinue the "far-field" groundwater monitoring requirements and to modify the "near field" groundwater monitoring requirements.

2. Adopt a procedure for handling "extreme values" in monitoring data for use in reviewing and interpreting the results of the long-term monitoring program.

3. Continue inspecting the remedial action to confirm structural integrity and take necessary actions if structural integrity issues should be detected.

With the completion of four decision documents and the continuation of annual inspections by the Inspection Committee each of these goals has been achieved.

During February, 1999, Olin submitted its proposals for a monitoring program, interim goals, and contingency plans which were required as a condition of the Review Panel extension of time to attain the performance standard for catfish and smallmouth buffalo. The RP reviewed and approved Olin's proposals. The RP will also focus on achieving each of the major milestones established by the Consent Decree as depicted in Figure 3 (see also appendix A).

MAJOR CONSENT DECREE MILESTONES

Date Accomplished	Event
May 31, 1983	Consent Decree Signed
August 31, 1984	Approved modified Remedial Action
January 1, 1988	Construction completed; Long-Term Monitoring began
December 31, 1998	Initial Monitoring complete
On or before	
December 31, 2007	Attain performance standards in all Reaches
December 31, 2009	Demonstrate continued attainment for all fish and reaches.
December 31, 2016	Demonstrate final compliance

Chapter 6 Review Panel Agency Studies

Each of the Review Panel represented agencies have agency program responsibilities in the HSB-IC-Wheeler Reservoir area. This chapter provides a summary of those activities during the report period which would provide supporting information to the remedial actions in the HSB-IC area..

Environmental Protection Agency, Region IV

The Superfund program has conducted two five year reviews during this period (1992 and 1999). The review conducted by an independent contractor, included site visits, reviews of data, interviews, and some sample collection. The 1999 review found that the remedial action is accomplishing its goal of preventing contact between the ecosystem and DDT. All diversion, drainage, and filled structures appear sound. No signs of physical deterioration were noted. And it that the remedial action taken at this site continues to be protective of human health and the environment.

The Science and Ecosystem Support Division, (SESD), Region IV, EPA, serves as the referee laboratory and provides a senior chemist who co-chairs the QA Committee. During this period, SESD has analyzed nearly ten percent of the fish samples collected by Olin and conducted several studies to evaluate analytical methods and data quality. In the future SESD will provide QA support.

Department of the Army

Redstone Arsenal Activities

Redstone Arsenal personnel provide direct support and access to the site for Olin and visitors to the site. Redstone Arsenal personnel routinely inspect the site and perform a variety of studies and chemical monitoring both on the remediation site and adjacent areas. They have also assisted USFWS studies on the refuge and the installation of wood duck boxes in the project area. Arsenal natural resource personnel will continue to monitor changes in plants and animals in the ecosystem, for evidence of recovery.

U.S. Army Corps of Engineers

Since July 1, 1990, the USACE has conducted numerous inspections of the remedial project. These inspections were normally conducted in conjunction with the semi-annual Review Panel meetings. During these inspections, the stability of the stream channel and revegetation of the fill areas was examined in particular. The channels have experienced relatively minor changes during the period covered by this report. Vegetation has not colonized the sediment bars to the extent that flow is being impeded or diverted. At this time, there does not appear to be any stability issues related to the diversion structures or channels. Natural revegetation is rapidly occurring on the fill areas with extensive areas of woody growth in Upper Reach A. Natural revegetation has also continued in the rip-rap and along the stream channels. At this time, USACE agrees with the consensus opinion of the Review Panel that growth of vegetation in the project area does not present a problem. USACE will continue to perform routine inspections in the future and monitor these areas to determine if maintenance is required.

The Corps of Engineers has actively tried to resolve a trash and debris problem in Huntsville Spring Branch. Historically, trash and debris has entered Huntsville Spring Branch during heavy rainfalls, particularly from the city of Huntsville. Then the Branch carries it downstream to depositional areas on Redstone Arsenal and Wheeler National Wildlife Refuge. A September 1995 reconnaissance report recommended diverting the trash and debris flow from the main stream channel to a Flex Rake located in a diversion channel where the material could be removed. The city has undertaken a study in the Huntsville Spring Branch area due to extensive flooding during the summer of 1999. Upon completion of that report, the Corps will make minor revisions (if necessary) to the trash collection system plans and specifications. Construction would be able to proceed upon resolution of any final issues.

Fish and Wildlife Service

Personnel with the FWS have investigated DDT residues in various trust resources during the same period that Olin has conducted its post-remediation monitoring. The FWS has used red-wing blackbird nestlings, wood duck eggs, and waterfowl wings to evaluate whether the original remediation and performance standard (5 ppm total DDT residues in fish filets) is protective of other trust resource species using Wheeler National Wildlife Refuge. The DDTR residues in

redwing blackbird and wood duck samples have shown a decrease over time indicating that the remediation appears to have reduced environmental exposures to these organisms.

To supplement Olin's analysis of fish filets, the FWS has also collected and analyzed whole- body fish samples of various species. Because of inconsistent collection of species, the FWS focused on one of the performance standard species (largemouth bass) in 1994. Fillet samples were analyzed, various tissue samples collected for histopathological examination, and a fish health assessment conducted during the field sampling. Total DDT residues in fillet samples agreed well with results reported by Olin (<5 ppm). Internal and external examination of the fish specimens in the field indicated that fish were fairly healthy. Sections of liver and reproductive tissues prepared for histological examination had no signs of tumors, pre-neoplastic lesions, or other abnormalities. Histological examination was done by Dr. John Harshbarger, with the National Cancer Institute.

The FWS will continue to participate in the Review Panel and Technical Committee. The agency will also continue to conduct follow-up evaluations of the remediation project. The FWS plans to repeat the fish health investigation using the other two performance standard species (channel catfish and smallmouth buffalo).

Tennessee Valley Authority

TVA has worked closely with the State of Alabama to collect and analyze levels of DDT and other toxic contaminants in fish from Wheeler Reservoir for use in fish consumption advisories in the reservoir. TVA also collects basic information on water quality and biological conditions in Wheeler Reservoir. They provide technical assistance and data for gaging stream flows which Olin uses for hydrology and sediment transport studies. TVA has also provided extensive information on fish populations and basic life history. TVA will continue to evaluate results from long term monitoring focusing on effects of changes in the age distribution of performance standard fish, body fat levels, and other factors to assure that reported DDTR concentrations are valid estimates of each age class of fish.

Alabama Department of Environmental Management

During the report period, ADEM collected and analyzed fish tissue samples from the mainstem of the Tennessee River, the results of which supported the lifting of a fish consumption advisory in that area. The Department also reviewed data collected by Olin and participated in associated deliberations of the Review Panel. The Department provided the Chairman for the Inspection Committee and coordinated periodic assessments of the physical integrity of the remedy, rendering associated reports reflecting continued stability of remedial action on this site.

Introduction to Volume 2

On May 31, 1983, U.S. District Court Judge Robert B. Propst entered, as part of an order settling litigation against Olin Corporation, a Consent Decree (CD) governing remedial action for DDTR contamination in the Huntsville Spring Branch-Indian Creek (HSB-IC) system. The CD requires Olin to develop and implement a plan consistent with the goals and objectives of the CD to meet a performance standard of 5 parts per million (ppm) DDTR in filets of channel catfish, largemouth bass, and smallmouth buffalo in specified reaches of the HSB-IC system.

The CD established a Review Panel (RP) with voting members from the U.S. Environmental Protection Agency (EPA), Tennessee Valley Authority (TVA), U.S. Fish and Wildlife Service (FWS), Department of the Army (DOA), and Alabama Department of Environmental Management (ADEM), and non-voting participants from Triana, Alabama (Triana) and Olin Corporation (Olin). This volume contains documents that are pertinent to the Review Panel activities during the period July 1990 - April 23, 1999.

Appendices (Volume 2)

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Appendix A. Project Chronology

For period May 31, 1983 through April 23, 1999

May 31, 1983	Court approved Consent Decree for US vs Olin Corp
June 14, 1983	Review Panel established.
January 26, 1984	Review Panel adopted operating procedures.
June 1, 1984	Olin submitted remedial action plan to RP.
July 14, 1984	Public Meeting, Triana, AL, to receive comments on Olin's Proposed Remedial Action Plan.
August 31, 1984	RP issued first decision document approving Olin's Proposed Remedial Action Plan with modifications.
January 2, 1985	USACE Nashville District initiated Environmental Impact Statement Public Scoping Process.
February 5, 1985	Olin submitted draft permit applications to RP and permitting agencies (USACE, USFWS, TVA, Alabama, and EPA).
July 1, 1985	Olin submitted: 1) final engineering drawings and specifications and environmental analysis report; 2) permit applications to USACE Nashville District, TVA, and US FWS; and 3) report on field and laboratory investigations of the Huntsville Spring Branch-Indian Creek (HSB-IC) system to the RP.
July 17, 1985	USACE Nashville District issued notice of availability of draft EIS for permitting activities.

August 1, 1985	Olin submitted to the RP: 1) remedial action alternatives report for Lower Reach A (LRA) and 2) interim goals report.
December 2, 1985	Department of Army (DA) issued license to Olin for remedial action construction activities on Redstone Arsenal.
January 11, 1986	Olin submitted revised permit applications and detailed engineering plans to RP, USACE Nashville District, TVA, and USFWS.
January 28, 1986	USFWS issued limited authorization to begin site preparation and mobilization within the boundaries of Wheeler National Wildlife Refuge (WNWR).
February 21, 1986	Final EIS issued by the USACE Nashville District.
March 1, 1986	Olin submitted special reports: baseline conditions for water and fish; substitute fish species; long-term data acquisition program (revised); and interim goals.
March 24, 1986	Close of public comment period on final EIS.
March 25, 1986	Alabama Department of Environmental Management (ADEM) issued 401(a) certification.
March 31, 1986	Applicable permits issued to Olin.
April 1, 1986	USFWS issued permit and construction began on Upper Reach A (URA).
April 23, 1986	Groundbreaking Ceremony for URA.

July 2-8, 1986	RP approved and regulatory agencies modified permits for relocation of the northern diversion ditch in URA.
July 16, 1986	HSB diverted to new channel in URA (salient cut opened June 11 and oxbow cut opened July 16).
September 15, 1986	Olin submitted preliminary applications for permits on Lower Reach A (LRA).
October 1, 1986	USACE issued public notice of remedial action proposal for LRA.
October 2, 1986	Olin, with RP concurrence, committed to start construction in LRA by December 1, 1986.
October 21, 1986	Olin issued proposed engineering drawings for the remedial action in LRA, highlighting areas where construction activities were proposed prior to December 1.
October 28, 1986	RP held public meeting at Triana concerning the remedial action for LRA and RP issued Decision Document 2, baseline data, substitute species, and interim goals for fish and water.
November 18, 1986	ADEM issued 401(a) certification for remedial action in LRA.
November 21, 1986	USFWS issued permit for remedial action in LRA.
November 28, 1986	TVA and USACE issued permits for remedial action in LRA.
December 1, 1986	Construction mobilization began for remedial action in LRA.

December 9, 1986	RP issued Decision Document 3, remedial action plan to isolate DDTR in LRA and full construction began in LRA.
January 18, 1987	Construction of diversion structure No. 4 in LRA completed to elevation 558.
February 16, 1987	Mechanical excavation of bottom sediments between HSBM 3.4 and 4.0 in LRA completed.
March 18, 1987	HSB diverted to new channel in LRA.
April 16, 1987	RP issued Decision Document 4, report on DDTR in Reaches B and C of the HSB-IC system.
May 20, 1987	Revised plan submitted to RP for demobilization following completion of construction in URA and LRA.
May 20, 1987	Eight-foot alligator captured in LRA and relocated with USFWS assistance.
July 22, 1987	Major construction activities completed; ceremony held at remedial action site.
July 22, 1987	RP issued Decision Document 5, substitute species for largemouth bass.
August 19, 1987	USACE Nashville District, issued report of interagency regulatory committee inspection conducted August 3, 1987; no major deficiencies of permit conditions identified.
September 14, 1987	RP inspection committee (including representatives of all agencies) issued report of August 27 inspection to RP Chair certifying the "as built" remedial action for URA and LRA meets or exceeds requirements of the decision documents 1 and 3, plans and specifications approved by

	the RP.
October 14, 1987	RP Chair transmitted to Olin his concurrence with the interagency regulatory inspection committee and the RP inspection committee certification; requested Olin to submit for a approval a proposed date for completion of construction and start of the long-term monitoring program.
October 15, 1987	Olin transmitted letter to RP Chair proposing January 1, 1988 as the date for the "designated event" signifying completion of construction and implementation of the remedy as required by Decision Document 3 and CD, paragraph 52(j).
December 3, 1987	RP approved January 1, 1988 as completion of construction and start of long-term monitoring period; issued Decision Document 6, long-term monitoring program for the remedial action in the HSB-IC system.
December 3, 1987	Howard Zeller announced his resignation as Chair of the RP, effective December 31, 1987; Anne Asbell appointed RP Chair effective January 1, 1988; Anne Asbell requested continuation of the technical committee and inspection committee. RP adopted a semiannual meeting schedule in lieu of the quarterly meeting schedule held through December 3, 1987.
January 1, 1988	Anne Asbell became RP Chair. Official completion of construction and beginning of the initial remedy as required by the Decision Document 3 and CD, paragraph 52 (j).
February 9, 1989	Olin requested change in the due date for the long-term monitoring reports from March 1 to April 15 of each report year.

February 22, 1989	RP informally concurred with requested change in due date for the long-term monitoring report.
April 14, 1989	Olin submitted long-term monitoring report 1.
June 13, 1989	Technical Committee, Inspection Committee, and RP jointly inspected remedial action project.
June 14, 1989	RP requested Olin and EPA jointly propose data validation procedures for the long-term monitoring program.
November 21, 1989	Olin and EPA proposed long-term monitoring program data validation; Olin proposed optimum number of fish to be collected.
December 7, 1989	RP modified Decision Document 6 to change the due date of long-term monitoring program reports to April 15.
April 15, 1990	Olin submitted long-term monitoring program report 2.
June 11, 1990	Inspection Committee reported on June 13, 1989 inspection of remedial action.
June 13, 1990	Inspection Committee, Technical Committee and RP jointly inspected project.
June 14, 1990	RP issued Decision Document 7, quality assurance and fish sample size. RP approved termination of the "far-field" groundwater monitoring program and reduced frequency of the "near-field" groundwater monitoring program.
June 25, 1990	Inspection Committee reported on June 13, 1990 inspection of the remedial action project site.

December 6, 1990	Decision Document No. 8 to terminate Technical Proposal Groundwater Monitoring until Year 10 (1997).
January 23, 1992	Decision Document No. 9, Process for Review of Monitoring Data and Olin Notification of Compliance by the Technical Committee .
July 15, 1993	Huntsville DDT Project Public Meeting to inform the Public of the progress toward meeting the performance standards.
January 19, 1995	Review Panel Decision Document No. 10, Process for Review of Continued Attainment defined. Appendix A to Document Number 10 found that Continued Attainment had occurred for Largemouth Bass in Reach C.
July 20, 1995	Finding of Continued Attainment Largemouth Bass, Reach A and Reach B (Appendices B and C to Decision Document Number 10).
May 17, 1996	Report on Interlaboratory Quality Assurance and Quality Control
July 24-25, 1996	Detailed Review of long term monitoring program results with the Review Panel and Technical Committee
March 17, 1997	Post Remediation Sediment Investigation – Reach A and Reach B
May 15, 1998	Olin proposes a time extension for meeting the performance standard for channel catfish and smallmouth buffalo.
July 23, 1998	Review Panel reviews Olin's proposal for a time extension.

September 15, 1998	Public meeting on Olin's proposal to extend time to meet the performance standard for channel catfish and smallmouth buffalo.
October 2, 1998	Letter of Inspection Committee on vegetation and stability of Remedial Action Site through monitoring period.
December 21, 1998	RP Decision Document Number 11, to Extend Time for Meeting the Performance Standard for Channel Catfish and Smallmouth Buffalo.
February 3, 1999	Olin submitted interim goals and contingency plans for Extension Period.
February 25, 1999	U.S. Department of Justice and Olin jointly petitioned the court to modify the schedule to attain the performance standard.
April 23, 1999	Court Order modified schedule to meet performance standards.

Appendix B. Consent Decree and Joint Technical Proposal

Appendix C

REVIEW PANEL MEMBERSHIP

Review Panel Chair

Dr. Edward S. Bender
Office of Science Policy (8103R)
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

E-mail Address: bender.ed@epamail.epa.gov

Period of Review Panel service–June 14, 1983 to present
(Dr. Bender was appointed Chair of the Review Panel on December 5, 1996 following the death of Anne Asbell)

Dr. Bender is an aquatic biologist with the U.S. Environmental Protection Agency in Washington DC. He chairs the Technical Committee which provides advice and support for Review Panel activities. In 1977, while working for the U.S. Army, Dr. Bender became involved with DDTR sampling at Redstone Arsenal. He joined EPA in 1979 and served as the technical coordinator for the litigation that led to the Consent Decree in U.S. vs Olin Corporation, and the establishment of the Review Panel. Dr. Bender has more than twenty years experience in environmental monitoring, aquatic ecology and toxicology. His dissertation, entitled "Recovery of a Macroinvertebrate Community from Chronic DDTR Contamination," studied the toxic effects of DDTR runoff from an abandoned manufacturing facility on fish and aquatic invertebrates in a south-central Arkansas stream. Dr. Bender has a bachelor of science degree in biology from Westminster College, a master of science degree in zoology from the University of Florida, and a doctorate in biology from the Virginia Polytechnic Institute and State University.

Voting Members

Environmental Protection Agency

Alan W. Yarbrough
U.S. Environmental Protection Agency
Region 4, Waste Division
South Site Management Branch
61 Forsyth Street, S.W.
Atlanta, Georgia 30303-3104

E-mail Address: yarbrough.alan@epamail.epa.gov

Period of Review Panel Service - 1997 to present

Mr. Yarbrough is a staff Environmental Scientist in EPA and has served as a Project Manager for the Agency since 1990. During 1990 until 1997, Mr. Yarbrough's involvement with the Triana/Tennessee River DDTR site included authoring a close-out report to document the completion of construction and initiating a five-year review , both under the Superfund Program. Since the Triana/Tennessee River DDTR site is a pre-SARA (Superfund Amendments and Reauthorization Act of 1986) Site, the close-out report and five-year review were necessary to incorporate the Triana/Tennessee River DDTR site in the proper place along the Superfund pipeline. Mr. Yarbrough has a Bachelor of Science from Mercer University and a Master of Science from the Georgia Institute of Technology.

State of Alabama

James W. Warr
Director
Alabama Dept. Environmental Management
P.O. Box 301463
Montgomery, AL 36130-1463

Email "jww@adem.state.al.us"

Period of Review Panel Service: June 14, 1983 to present

Mr. Warr is the Director of the Alabama Department of Environmental Management (ADEM), a position that he has held since April 1996. Prior to April 1996, Mr. Warr was the Deputy Director from August 1982 (when ADEM was created) to November 1993 and from November 1994 to September 1995. He served as the Acting Director from November 1993 to November 1994 and from September 1995 until April 1996 when he became the Director. ADEM is responsible for the implementation and coordination of the State of Alabama's environmental program activities. Mr. Warr was previously the Director of the Alabama Water Improvement Commission (AWIC), which administered the Alabama Water Pollution Control Act. He joined the AWIC in 1968 and has several years of experience and knowledge concerning the environmental conditions in the Wheeler Reservoir, Huntsville Spring Branch – Indian Creek System. Mr. Warr has a Bachelor of Science Degree in Civil Engineering, a Masters Degree in Civil Engineering, and a Master of Business Administration, all from Auburn University. He is a registered professional engineer and is a member of several professional associations. He currently holds the rank of Major General in the U.S. Army Reserve.

Department of Army, RSA

Colonel Steven C. Hamilton
Deputy Post Commander
AMSAM
Redstone Arsenal, AL 35898-5300

Period of Review Panel service—July 1998 to present

Colonel Hamilton was assigned as Deputy Post Commander, Redstone Arsenal, Alabama in July 1998. Previous assignments have been Platoon Leader, 2-34th Infantry, Ft. Stewart, GA; Executive Officer, 24th Ordnance Company, Ft. Stewart, GA; Commander, Surveillance and Accountability Control Team #1 (SAACT #1), 6th Ordnance Battalion, Uijongbu, Korea; Materiel Officer, 80th Ordnance Battalion, Ft. Lewis, WA; Commander, 63rd Ordnance Company, Ft. Lewis, WA; and Operations Officer, Test and Evaluation Division, Army Development and Employment Agency (ADEA), Ft. Lewis, WA. He served as Executive Officer, 80th Ordnance Battalion, Ft. Lewis, WA; Chief, Ammunition Management Branch, 3D COSCOM, Germany; Chief, Supply Management Division, 3D COSCOM, Germany and Commander, 6th Ordnance Battalion, Korea. His most recent assignments have been as Action Officer, J-4, The Joint Staff, Pentagon; Chairman, Joint Munitions Rule Implementation Council (MRIC), Pentagon and Chief, Plans and Operations Division, ODCSLOG, Pentagon. Colonel Hamilton's awards and decorations include the Defense Meritorious Service Medal, the Meritorious Service Medal with 3 Oak Leaf Clusters, the Joint Service Commendation Medal, the Army Commendation Medal with Oak Leaf Cluster, the Joint Chiefs of Staff Identification Badge, the Army Staff Identification Badge, the Parachutist Badge and the Ranger Tab. Colonel Hamilton holds a bachelor of science degree in Medical Technology from the University of Utah, a master of business administration degree from Utah State University and a master of science in National Resource Strategy from the National Defense University. Colonel Hamilton was commissioned a second lieutenant in the Ordnance Corps with a detail in infantry in 1975. He is a graduate of the Infantry Officer Basic Course, the Ordnance Officer Advance Course, the Materiel Acquisition Management Course, the Command and General Staff College, and the Industrial College of the Armed Forces.

US Fish and Wildlife Service

Dr. W. Allen Robison
Environmental Contaminants
Coordinator-Southeast Region
U.S. Fish & Wildlife Service
1875 Century Blvd.
Suite 200
Atlanta, GA 30345

Email "allen_robison@fws.gov"

Period of Service: July 15, 1993 to present.

Dr. Robison holds degrees in wildlife biology, aquatic biology and toxicology. He has worked for the Fish and Wildlife Service (Service) as a Biological Technician, an Environmental Contaminants Biologist, and as an Ecologist. Dr. Robison has also worked in the areas of water quality assessment, fish community analysis, fish contaminant residue evaluation, and the transport/fate of PCBs for the Commonwealth of Kentucky. His involvement with the HSB-IC DDT project began when he came to work in the Service's Tennessee/Kentucky Field Office located in Cookeville, Tennessee. Dr. Robison has continued the monitoring programs at Wheeler National Wildlife Refuge. He is presently employed in the Service's Southeast Regional Office located in Atlanta, Georgia.

Tennessee Valley Authority

Robert Pryor
Business Development
Tennessee Valley Authority
400 Summit Hill Drive (WT-10D)
Knoxville, TN 37902-1499

Email "rjpryor@tva.com"

Period of Review Panel Service: January 1, 1991to present.

Mr. Pryor has over 20 years of accountable management experience in environmental and pollution prevention disciplines. He has a technical background in scientific and environmental engineering professions and broad experience in all TVA businesses. For example, he has managed assessment and protection programs for natural resources, served as Project Engineer for capacity additions to the Power System from siting to sub-system modifications. Advised agency management on effects of operations on natural resources and provided corporate-level oversight of environmental activities at operating sites, has management responsibility for performing National Environmental Policy Act reviews.

He has a master of science in zoology and a bachelor of science in biology and chemistry from the University of Texas at San Angelo, Texas. He also has an engineering certification from Texas A&M.

NON-VOTING MEMBERS

Town of Triana, AL

Honorable Clyde Foster (Town Hall)
480 Zierdt Road
Triana, AL 35756

E-mail "cfoster293@aol.com"

Mr. Foster, formerly the Mayor of the Town of Triana, Alabama, is a prominent community leader. He was instrumental in the restoration of the town charter for Triana, originally chartered in 1819, and was appointed Triana Mayor in 1964, serving in that capacity until 1984. He has been a strong community advocate and instrumental in focusing community concerns. His efforts on behalf of the town of Triana have been successful in improving many areas of community life.

Mayor Foster has been involved with the resolution of the DDTR contamination problem in the Huntsville Spring Branch-Indian Creek System for many years. His contributions include effective and successful coordination of the Review Panel activities with the local community. His efforts have resulted in a spirit of cooperation and understanding within the community.

Mayor Foster was the Director of the Equal Employment Office at the National Aeronautics and Space Agency, George C. Marshall Space Flight Center in Huntsville, Alabama until his retirement in January 1987. He has a bachelor of science degree in mathematics and chemistry from Alabama A & M, and has taken graduate courses at that university.

Olin Corporation

Mrs. Laura B. Tew
Director, Community Outreach
Olin Corporation
PO Box 248
Charleston, TN 37310

E-Mail: lbtew@corp.olin.com

Period of Review Panel service: 1998 to present

Mrs. Tew is Director of Corporate Community Outreach with Olin Corporation's Public Affairs department. She has been with Olin for twenty-two years and has served on the Review Panel as Olin's non-voting member since 1998. Mrs. Tew has an undergraduate degree in chemistry from the University of North Carolina at Greensboro, advanced studies in chemistry at Duke University, and an MBA in marketing from Pace University in White Plains, NY. Mrs. Tew's career with Olin has included positions in quality, environmental, production management and marketing. She was plant manager of Olin's packaging facility in Livonia, MI. Mrs. Tew holds an advanced certificate from Boston College, Center for Corporate Community Relations.

FORMER REVIEW PANEL MEMBERS

Past Chairs

U.S. Environmental Protection Agency

Mr. Howard D. Zeller
Period of Review Panel service: June 14, 1983 through December 31, 1987

Mr. Zeller served as the first Chair of the Review Panel and the United States' designated Program Coordinator for the implementation of the Consent Decree in U.S. vs Olin Corporation. Mr. Zeller was the Assistant Administrator for Policy and Management for the U.S. Environmental Protection Agency in Atlanta, Georgia until his retirement in January 1987. Mr. Zeller retired with more than thirty years experience in environmental matters. He lead the Review Panel through the initial phases of implementing the Consent Decree and adopting procedures for functioning as a body. Mr. Zeller has a bachelor of science degree in biology and chemistry from the University of Nebraska and a master of science degree in zoology from the University of Missouri.

Ms. Anne Asbell
Period of Review Panel service: June 14, 1983 through November 2, 1996

Ms. Asbell was the second Chair of the Review Panel from January 1987 until her death, November 2, 1996. She served as the Legal Counsel for the Review Panel from 1983 until her appointment as Chair. She was an Associate Regional Counsel for the U.S. Environmental Protection Agency, Region IV, in Atlanta, Georgia. Ms. Asbell represented the Region in the litigation that led to the Consent Decree and the establishment of the Review Panel. She was actively involved in all aspects of the Review Panel activities and the implementation of the Consent Decree. Ms. Asbell had a juris doctor degree from Woodrow Wilson College of Law.

Former Members

Tennessee Valley Authority

Mr. Bruce Brye
Period of Review Panel service: June 14, 1983 to December 31, 1990

During Mr. Brye's service as TVA's representative on the Review Panel, he also served as Chairman of Review Panel's Inspection Committee. Mr. Brye was a staff Environmental Engineer in the TVA's Division of Water Resources and served as TVA's senior technical expert on water quality issues. Since 1963, Mr. Brye has been involved in the environmental review , permitting, licensing, and litigation of many major TVA projects. During 1979-1980, Mr. Brye was extensively involved in the data acquisition activities for the DDTR studies of the environment in the Huntsville Spring Branch-Indian Creek System. During 1981-1983, he provided assistance to the U.S. Environmental Protection Agency and the Department of Justice in the development and review of technical documents during the negotiations which led to the final consent decree in U.S. vs. Olin Corporation. After his retirement from TVA in 1991, Mr. Brye was retained by the Review Panel as a consultant. Mr. Brye has a bachelor of arts in mathematics from Wartburg College, a bachelor of science in civil engineering (sanitary option) from the University of Iowa, and a master of science in sanitary engineering from the University of Iowa. He is a Diplomat in the American Academy of Environmental Engineers, a Certified Hazardous Materials Manager, and a registered professional engineer in 14 states including Alabama.

U.S. Fish and Wildlife Service

1. Mr. W. Waynon Johnson

Period of Review Panel service: June 14, 1983, to March 10, 1987
Mr. Johnson was the Senior Staff Specialist with the US FWS in Atlanta, Georgia.

2. Dr. Lee A. Barclay

Period of Review Panel service–March 10, 1987, to December 3, 1987
Dr. Barclay was the Environmental Contaminants Specialist with the US FWS in Cookville, Tennessee.

3. Dr. Donald P. Schultz

Period of Review Panel service: December 3, 1987 through June 15, 1990
Dr. Schultz was the contaminant coordinator for the Southeast Region of the U.S. FWS.

4. Mr. R. Mark Wilson

Period of Review Panel service: June 15, 1990-December 12, 1992
Mr. Wilson was the Environmental Contaminants Specialist with the US FWS in Cookville, Tennessee.

4. Dr. Charles Facemire

Period of Review Panel service: December 12, 1992 - July 15, 1993
Dr. Facemire was the Regional Contaminants Coordinator for U.S. Fish and Wildlife Service, Atlanta, Georgia during that time.

Department of the Army

1. Colonel Dahl J. Cento (Retired)

Period of Review Panel service: June 14, 1983 to October 30, 1985
Colonel Cento was the Deputy Post Commander of Redstone Arsenal during his Review Panel service. He was active in soliciting participation by the Corps of Engineers.

2. Colonel James A. Hall (Retired)

Period of Review Panel service–August 1986 to June 1988.
Colonel Hall was named Deputy Post Commander, Redstone Arsenal in August 1986.

3. Colonel Perry C. Butler (Retired)

Period of Review Panel service: July 1988 to July 1991.
Colonel Butler was assigned as Deputy Post Commander in July 1988.

4. Colonel Stephen Peter Moeller (Retired)

Period of Review Panel service: July 1994 to July 1996.
Colonel Moeller was assigned as Deputy Post Commander in June 1994.

5. Colonel Duane E. Brandt

Period of Review Panel service: July 1996 to July 1998.
Colonel Brandt was assigned as Deputy Post Commander, Redstone Arsenal, Alabama in July 1996.

Former Non- Voting Review Panel Members

Olin Corporation

Mr. William G. McGlasson
Corporate Director, Environment, Health, & Safety
Olin Corporation
PO Box 248
Charleston, TN 37310

Phone: (423) 336-4734

Period of Review Panel service: 1990 to 1998

Mr. McGlasson was Corporate Director, Environmental, Health, and Safety for Olin Corporation and Olin's designated Program Coordinator for the implementation of the Consent Decree in U. S. vs. Olin Corporation from 1990 to 1998. He succeeded Mr. Verrill Norwood in July, 1990, who was Olin's primary technical representative in the negotiation of the Consent Decree and the development and implementation of the environmental remedy in the Huntsville Spring Branch-Indian Creek System. Mr. McGlasson served as Olin's non-voting member of the Review Panel from 1990 to until his retirement in 1998. During 22 years of service with Olin, Mr. McGlasson served in various technical and management positions within Olin Corporation. He has a Bachelor of Science degree in Chemical Engineering from the University of Missouri and a Master of Science degree in Chemical Engineering from Louisiana State University.

Olin Advisor to the Technical Committee/Review Panel and Former Review Panel Participant

Mr. Verrill M. Norwood
Olin Consultant

116 Sunburst Lane NW
Cleveland, TN 37312

Phone: (423) 476-1082
E-Mail: vmnorwoo@piona.com

Period of Review Panel service: 1983 to 1990

Mr. Norwood was Vice President, Environmental Affairs, for Pioneer Chlor Alkali and is retired. Previously, he was Vice President, Environmental Affairs, for Olin Corporation and Olin's designated Program Coordinator for the implementation of the Consent Decree in U. S. vs. Olin Corporation. He was Olin's primary technical representative in the negotiation of the Consent Decree. Mr. Norwood served as Olin's non-voting member of the Review Panel from its inception until he was succeeded by Mr. William G. McGlasson in July, 1990. Mr. Norwood has continued on a contract basis to be an advisor to Olin and participate in the Technical Committee and Review Panel meetings. Mr. Norwood has a Bachelor of Science degree in Chemical Engineering from the Massachusetts Institute of Technology and a Master of Science degree in Chemical and Metallurgical Engineering from University of Michigan.

Appendix D. Inspection Committee Letter

Appendix E. Olin Reports Submitted to the Review Panel

Report Title	Date
Huntsville Quality Assurance/Method Equivalency Report	August 1, 1983
Huntsville Quarterly Report No. 1	September 1, 1983
Huntsville Groundwater Report	November 17, 1983
Huntsville Quarterly Report No. 2	December 1, 1983
Huntsville Analytical Methods Manual	February 22, 1984
Huntsville Quarterly Report No. 3	March 1, 1984
Huntsville Quarterly Report No. 4	June 1, 1984
Huntsville Remedial Action Report	June 1, 1984
Huntsville Quarterly Report No. 5	September 1, 1984
Huntsville Quarterly Report No. 6	December 1, 1984
HSB-IC Long-Term Data Acquisition Report	February 1, 1985
Draft 404/26a Permit Application	February 5, 1985
Huntsville Quarterly Report No. 7	March 1, 1985
Huntsville Engineering Quarterly Report No. 1	March 1, 1985
Huntsville Preliminary Engineering Drawings	April 1, 1985
Second Draft 404/26a Permit Application	April 19, 1985
A Cultural Resource Survey for the Huntsville Remedial Action Plan	May 13, 1985
Huntsville Quarterly Report No. 8	June 1, 1985
Huntsville Engineering Quarterly Report No. 2	June 1, 1985
Final Engineering Drawings and Specifications	July 1, 1985
404/26a Permit Application	July 1, 1985
Environmental Analysis for the Huntsville Remedial Action Plan	July 1, 1985
Field and Laboratory Investigations of the HSB-IC System	July 1, 1985
Report on DDT in HSBM 4.0 to 2.4 (Lower Reach A)	August 1, 1985
HSB-IC Post Remedial Action Interim Goals	August 1, 1985
Huntsville Quarterly Report No. 9	September 1, 1985
Huntsville Engineering Quarterly Report No. 3	September 1, 1985
Huntsville Groundwater Monitoring Program	November 20, 1985
Springs Report	November 27, 1985
Huntsville Quarterly Report No. 10	December 1, 1985

Huntsville Engineering Quarterly Report No. 4	December 1, 1985
Huntsville Remedial Action Plan Policy and Procedures Manual	January 6, 1986
Cultural Resources Survey Report (Oxbow Alternative)	January 7, 1986
Assessment of Revegetation Needs for the Olin Corporation Huntsville Remedial Action Plan	January 15, 1986
Final Engineering Drawings (Oxbow Alternative)	January 15, 1986
Huntsville Quarterly Report No. 11	March 1, 1986
Huntsville Engineering Quarterly Report No. 5	March 1, 1986
HSB-IC Long-Term Data Acquisition Report	March 1, 1986
HSB-IC Substitute Fish Species Report	March 1, 1986
HSB-IC DDT in Fish and Water Baseline Report	March 1, 1986
Huntsville Engineering Quarterly Report No. 6	June 1, 1986
404/26a Permit Modification	June 26, 1986
Catastrophic Subsidence Action Plan	July 30, 1986
Draft 404/26a Permit Application (Lower Reach A)	August 18, 1986
Huntsville Quarterly Report No. 12 (Semiannual No. 1)	September 1, 1986
Huntsville Engineering Quarterly Report No. 7	September 1, 1986
Report on DDT in Reach B and Reach C of the HSB-IC System	September 1, 1986
404/26a Permit Application (Lower Reach A)	September 15, 1986
Environmental Analysis for the Huntsville Remedial Action Plan (Lower Reach A)	September 15, 1986
Preliminary Engineering Drawings (Lower Reach A)	October 1, 1986
Technical Specifications for the Huntsville Remedial Action Plan (Lower Reach A)	October 1, 1986
Cultural Resource Assessment (Lower Reach A)	October 15, 1986
Endangered Species Monitoring Report	October 20, 1986
Revised 404/26a Permit Application (Lower Reach A)	October 27, 1986
Huntsville Engineering Quarterly Report No. 8	December 1, 1986
HSB-IC Long-Term Monitoring Program (Draft)	February 1, 1987
Evaluation of Substitute Fish for Largemouth Bass	February 6, 1987
Huntsville Semiannual Report No. 2	March 1, 1987
Huntsville Engineering Quarterly Report No. 9	March 1, 1987
HSB-IC Long-Term Monitoring Program (Draft)	May 5, 1987
Huntsville Engineering Quarterly Report No. 10	May 29, 1987
HSB-IC Long-Term Monitoring Program	August 14, 1987
Huntsville Engineering Quarterly Report No. 11	August 27, 1987

Huntsville Semiannual Report No. 3	September 1, 1987
Huntsville Project "As Built" Drawings	September 2, 1987
Huntsville Engineering Quarterly Report No. 12	December 8, 1987
Huntsville Semiannual Report No. 4	March 1, 1988
Huntsville Semiannual Report No. 5	September 1, 1988
Huntsville Long-Term Monitoring Report No. 1	April 15, 1989
Huntsville Long-Term Monitoring Report No. 2	April 15, 1990
Huntsville Long-Term Monitoring Report No. 3	April 15, 1991
Huntsville Long-Term Monitoring Report No. 4	April 15, 1992
1992 HSB-IC Interlaboratory Data Comparison	March 18, 1993
Huntsville Long-Term Monitoring Report No. 5	April 15, 1993
1993 HSB-IC Interlaboratory Data Comparison	May 11, 1994
Huntsville Long-Term Monitoring Report No. 6	June 1, 1994
1994 HSB-IC Interlaboratory Data Comparison	April 19, 1995
Huntsville Long-Term Monitoring Report No. 7	May 15, 1995
Huntsville Quality Assurance Meeting	September 13, 1995
1995 HSB-IC Interlaboratory Data Comparison	April 30, 1996
Report on Interlaboratory Quality Assurance and Quality Control	May 17, 1996
Huntsville Long-Term Monitoring Report No. 8	June 1, 1996
Post Remediation Sediment Investigation – Reach A and Reach B	January 6, 1997
1996 HSB-IC Interlaboratory Data Comparison	March 17, 1997
Huntsville Long-Term Monitoring Report No. 9	May 15, 1997
1997 HSB-IC Interlaboratory Data Comparison	March 24, 1998
Huntsville Long-Term Monitoring Report No. 10	May 15, 1998
Long-Term Monitoring Plan for Time Extension	February 1, 1999
Interim Goals for Time Extension	February 1, 1999
Contingency Plans for Time Extension	February 1, 1999

Appendix F. Decision Document No. 8,
Groundwater Monitoring, December 6, 1990

Appendix G. Decision Document No. 9,
Process for Review of Monitoring Data and
Olin Notification of Compliance by the Technical Committee,
January 23, 1992.

Appendix H. Decision Document No. 10,
Process for Review of Olin's Notifications of Continued Attainment
by the Technical Committee

Decision Document 10-Appendix A , Finding of Continued Attainment, Largemouth Bass, Reach C, January 19, 1995.

Decision Document 10-Appendix B, Finding of Continued Attainment Largemouth Bass, Reach A, July 20, 1995.

Decision Document 10-Appendix C, Finding of Continued Attainment Largemouth Bass, Reach B, July 20, 1995

Appendix I. Decision Document No. 11,
Extension of Time for Meeting the Performance Standard
for Channel Catfish and Smallmouth Buffalo,
December 3, 1998.

Appendix J
Joint Petition for Modification of Schedule to Meet Consent Decree Performance Standards and Court Order